WFS 340:
"Wetland Management"

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Lecture Structure

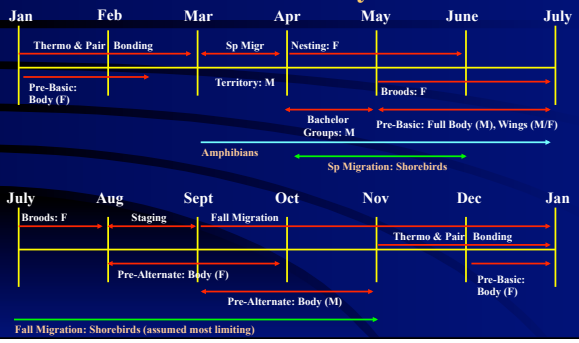
I. Annual Cycle

II. Waterfowl Diet & Management Complex

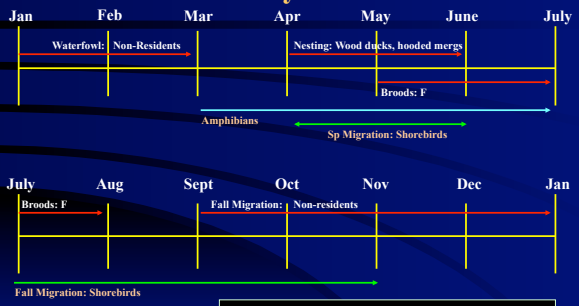
III. Moist-soil Management

IV. Agriculture Management

Managing Wetlands Throughout the Annual Cycle



Managing Wetlands Throughout the Annual Cycle: Southeast



Months of Least Activity: March & August

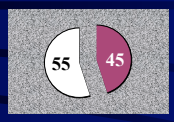
What do Ducks Eat??

Seeds and Invertebrates!!

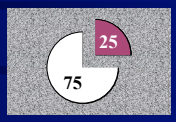
Life Cycle Events

- •Egg Production
- •Feather Production
- •Pre-Basic
- •Growth

➡ Proteinaceous Foods



Pre-Laying

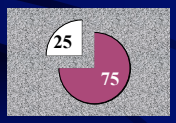


Laying

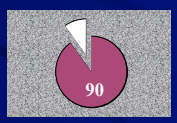
- •Fall Migration
- •Courtship
- •Thermoregulation
- •Spring Migration

➡ Energy-rich Foods

•Pre-Alternate: Don't Forget!



Post-Laying



Winter

Managing for Waterbirds & Amphibians: In the Southeast

Resident Waterfowl:

- •Cavity Trees
- •Brood rearing Habitat
- •Protein-rich Foods
- •April – July

Resident Amphibians:

- •Breeding and Larval Habitat
- •Semi-permanent: Fishless
- •Ephemeral Vernal Pools
- •April – July (most)

…an – April
(some anurans, mole salamanders)

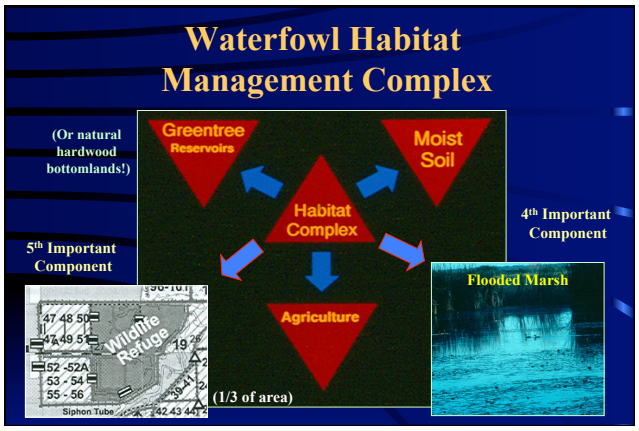
Migratory Waterfowl:

- •High-energy Foods
- •Moist-soil Wetlands, FW Marshes, & Agriculture
- •Scrub-shrub & Forested
- • Sept – early March (D, J, F)

Migratory Shorebirds:

- •Invertebrates
- •Mudflats
- • Late July – Nov (A, S)

Waterfowl Habitat Management Complex



Management of Moist-soil Wetlands for Waterfowl

Matthew J. Gray
University of Tennessee

Moist-soil Wetlands

General Definition

Intermittently to seasonally flooded wetlands that are dominated by annual and/or perennial herbaceous hydrophytes.

Moist-soil Wetlands

Specific Definition: Cowardin et al. 1979

Palustrine (System)

Late Seral Stage — Emergent Wetland — Early Seral Stage (Class)

Persistent | Non-Persistent (Subclass)

Perennial Rushes, Vines

Smartweed

Annual Grasses, Sedges

Intermittently Flooded, Temporally Flooded, Saturated, Seasonally Flooded (Water Regime)

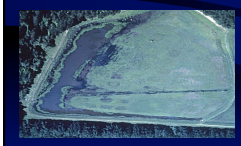
Moist-soil Management Unit

A location of moist-soil management, often surrounded by levees (impoundments)

<40 ha, 100 ac

Moist-soil Management Complex

A group of interconnected moist-soil impoundments that can be managed independently



Hydrologic Management

(Fredrickson and Taylor 1982)

Spring Drawdown:

Multiple Combinations Good!

Duration	Date
•Fast (2-3 days)	•Early (Mar-April)
•Slow (2-4 weeks)	•Late (Aug-Sept)
➡ Plant Diversity and Foods	➡ Succession & Breeding

Eco. Trap

Irrigation:

•Flooded shallowly (e.g., <10 cm)

•Offset drought

2-3 Weeks

Winter Flooding:

•Flood slow (2-4 weeks) & Sequential

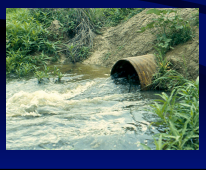
•Flood shallow (e.g., 10-20 cm)

Sept.

Hydrologic Management

Drawdown






Hydrologic Management

Growth & Irrigation

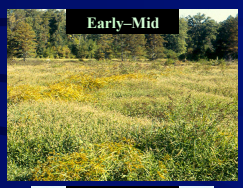


Hydrologic Management

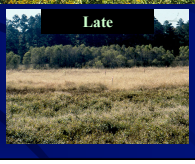
Vegetation Responses

Early

Early–Mid



Late



Hydrologic Management

Fall Flooding & Bird Response




Waterfowl Foods in Moist-soil Wetlands

Seed

Invertebrates

Tubers

Hydrologic Management

Water Control Structures

Drop-board

"Tongue-and-Groove"

Flap Gate

Screw Gate

Hydrologic Management

www.crisafulli.com

Moving Water

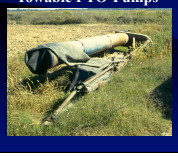
www.gator-pump.com

Gravity (reservoirs, rivers)

Cheapest!

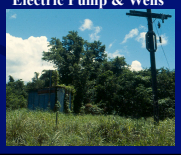
Diesel or PTO-Pumps & Wells

Towable PTO-Pumps



Crisafulli® & Gator®

Electric Pump & Wells



Mechanical Manipulations of Moist-soil Wetlands

(Fredrickson and Taylor 1982; Gray et al. 1999)

(Disking, Tilling, Scraping or Mowing)

Primary Goal: Set back Succession — 2-3 Years (Rotation)

Spring Manipulations: *(Historically: Northerly Approach)*

- Immediately after Early Spring Drawdown

Disking is Best!

Autumn Manipulations: *(SE Approach)*

- As soon as possible after Early or Late Drawdowns

Delays ➡ Heavy Precipitation, Breeding Waterfowl & Amphibians, SBs

- Long growing season and climate conditions can produce dense and continuous stands of hydrophytes

Secondary Goal: Waterfowl Access

Why Forego Mechanical Manipulations until Autumn?

3 Primary Reasons

Mechanical Manipulations




Mechanical Manipulations

How many Disk Passes are Necessary?

Usually 1-3 passes is sufficient



Offset Disk Best!

Mechanical Manipulations

Gray et al. (1999)

WSB 27: 770-779

Autumn Vegetation Responses

Disking and Tilling

Increased Vegetation Biomass
Increased Species Diversity
Increased Seed Yield

Mowing and Control

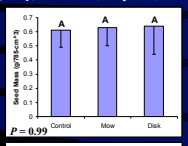
No Change in Vegetation!

Mowing in Autumn Good for Opening Dense Vegetation and Creating Landing Areas for Waterfowl

Fall Mechanical Manipulations

Moist-soil Wetlands

Are Seed Resources Lost?
(Gray, Kaminski, Hopkins; 1995)



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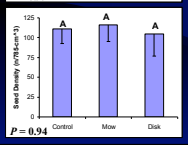

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Is it Illegal if Hunted Over?
(50 CFR Part 20; 1999)

No, if any of the following:

- Natural moist-soil wetland
- Natural moist-soil wetland with volunteer crops (including millet):
  - >1 yr since planting
- Unharvested agricultural crop
- Agricultural crop harvested via *bone fide* technique (i.e., combine)

Yes, if any of the following:

- Agricultural crop (including millet) that is manipulated via bush-hog or knocked down: <1 yr planting

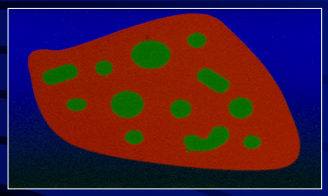
Mechanical Manipulations

Hemi-marsh Configuration

Smith et al. (2004)

Replication on Wintering Grounds

WSB 32:474-480



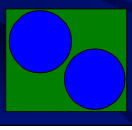
Aquatic Invertebrate Biomass Greatest

Kaminski and Prince (1981)

Hemi-marsh Concept

An approximate equal area of water and vegetation is ideal!

50:50 Ratio



Greatest Abundance and Richness of Waterbirds are Attracted

Weller (1970)

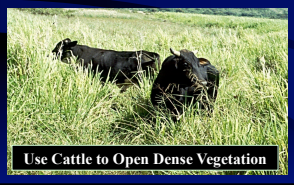
Natural Manipulations of Moist-soil Wetlands

Burning: (Use w/ Disking to set back succession)

- Release Nutrients
- Increase Nutritive Quality (Coastal Wetlands)
- Increase Plant H′
- Increase Aquatic Invert Biomass

Grazing: *(similar to mowing)* (Early Succession)

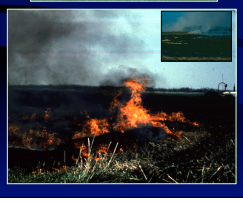
➡ Structural; Aquatic Invertebrates



Use Cattle to Open Dense Vegetation

Follow by Disking

Natural Manipulations of Moist-soil Wetlands



Rockefeller State Refuge

Other Manipulations of Moist-soil Wetlands

Release Grasses!

Herbicide Application

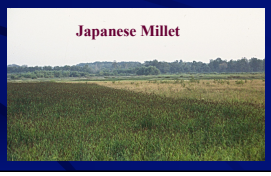
- Nuisance Plants
  - ➡ *Sesbania, Xanthium*
- 2,4-D, Renovate 3: Broad-leaved
- Glyphosate (Rodeo): Non-selective
- Habitat (Imazapyr): Invasive Exotics

$ ↓

Agriculture

- Ag. Var. Hydrophytes
- Higher Elevations
- Mid-June
- 40 kg/ha; $150/ha

Japanese Millet



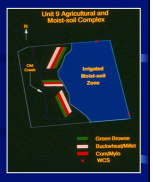
Agriculture Management

Corn + Moist-soil

Thus, birds can acquire high energy ag grains without flying long distances.

(Energy, Harvest Probability)

Crops Should be in Close Proximity to Natural Wetlands!!



Green Browse

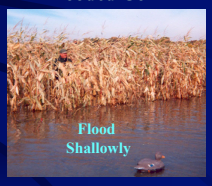
Geese!

Winter Wheat

Agriculture Management

Rice

Flooded Corn



Other Common Agricultural Foods

Milo, soybeans, browntop millet, and common buckwheat (*Fagopyrum esculentum*)

Agriculture Management

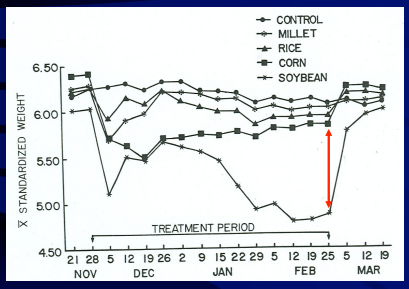
Rice and Millet

Better than

Soybean and Corn

3.5 kcal/g vs. 2.5 kcal/g

TME in Ag vs. MS



"Waterfowl cannot maintain body weight on agricultural seeds alone!" R. M. Kaminski and C. Loesch (1989)

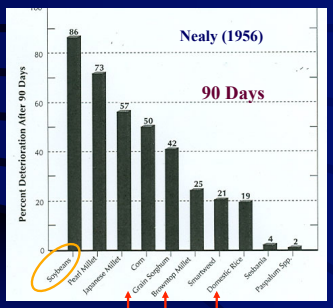
Mallards Metabolize Less Energy from Soybeans than other Ag Grains

Trypsin Inhibitor in Soybeans May Decrease Useable Protein (35%)

Agriculture Management

Why not Agriculture Only??

Moist-soil seeds decompose more slowly and retain their nutritional quality longer than agricultural grains.



Ag Seed

42–86% Decomposition

Moist-soil Seed

2–21% Decomposition

Food Available in Rice Fields

Manley et al. (2004), Stafford et al. (2005)

71%, 79-99% Decrease in Seed Availability

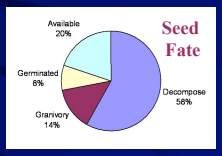
271 kg/ha Post Harvest → 78 kg/ha Late Autumn

WHY?

(Near 50 kg/ha Threshold; Greer et al. 2009)

Less Food (DED) Available!!

140 kg/ha → 752 DED/ha
325 DED/ha



Post-harvest Fates of Agricultural Seed in Tennessee Croplands

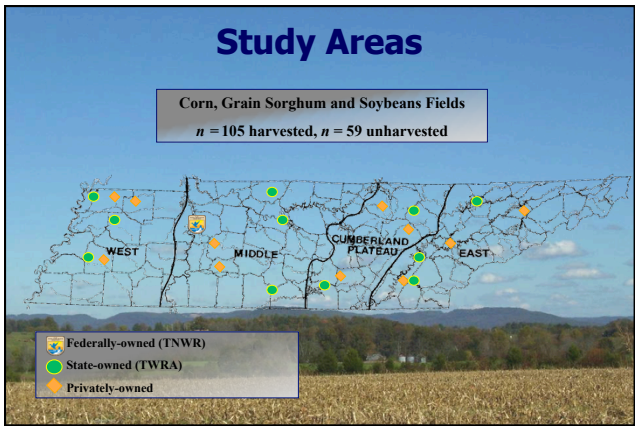
Melissa A. Foster, Craig A. Harper, Johnathan G. Walls, and Richard M. Kaminski

Matthew J. Gray
UT Wetlands Program
SEAFWA
19 October 2010

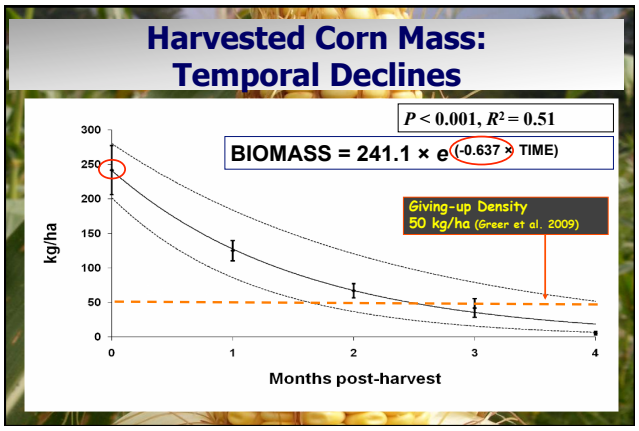
Study Areas

Corn, Grain Sorghum and Soybeans Fields

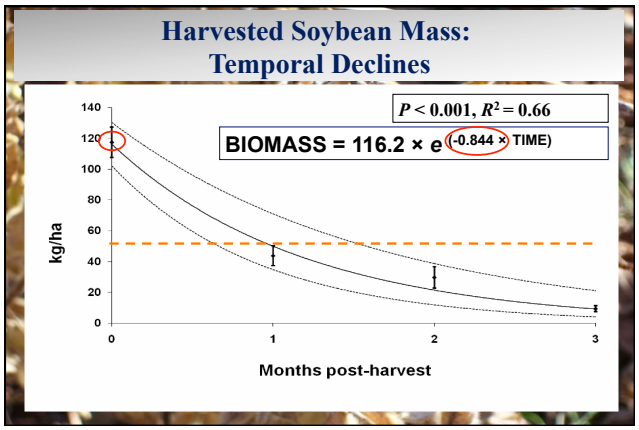
n = 105 harvested, *n* = 59 unharvested



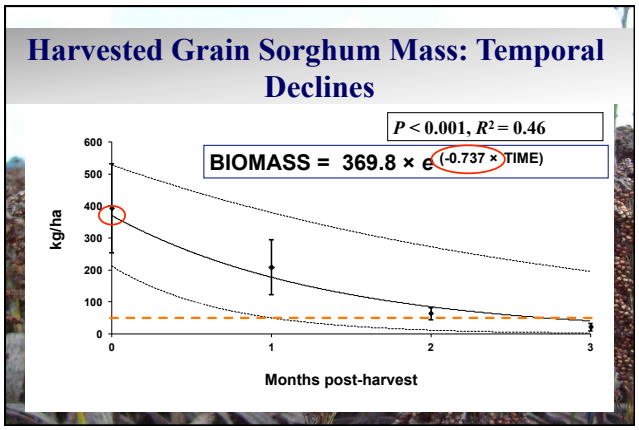
Harvested Corn Mass: Temporal Declines



Harvested Soybean Mass: Temporal Declines



Harvested Grain Sorghum Mass: Temporal Declines



December Estimates: Harvested Fields

		Biomass (kg/ha)		DED/ha	
Crop	*n*	$\bar{x}$	SE	$\bar{x}$	SE
Corn	47	75	14	522	160
Soybean	48	45	8	164	55
Grain Sorghum	9	156	83	1381	970

Moist-soil = 5000 DED/ha

December Estimates: Unharvested Fields

		Biomass (kg/ha)		DED/ha	
Crop	*n*	$\bar{x}$	SE	$\bar{x}$	SE
Corn	39	6,260	591	78,079	7,416
Soybean	16	2,190	439	19,423	3,987
Grain Sorghum	4	3,051	601	35,874	7,183

Moist-soil = 5000 DED/ha

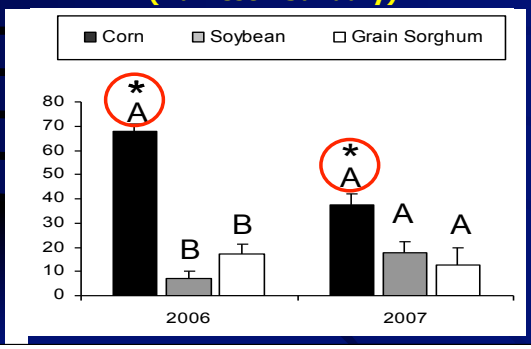
Harvested Crops: 160–1300 DED/ha

Photo: M. Wickens

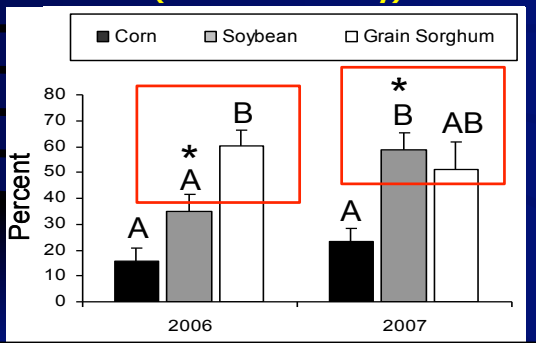
Part II: QUANTIFYING SEED FATE

In harvested fields, there is less available seed and it is disappearing quickly. What is happening to it?

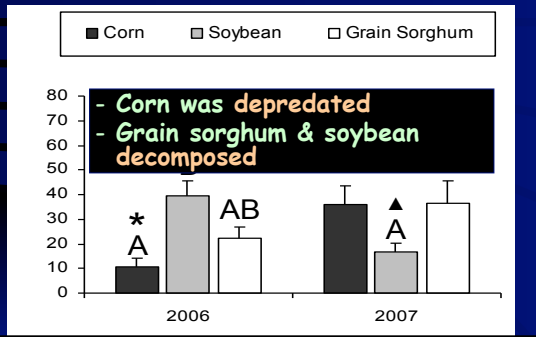
Total Depredation
(Harvest – January)



Total Decomposition
(Harvest – January)



Total Germination
(Harvest – January)



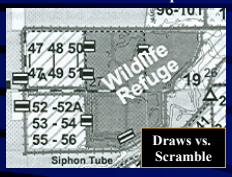
Hunting Agriculture

Flooded Fields

Harvested Fields

Create Hunting Access

Walk-in Access Ramps



Boat Pull-over Sites

Hand or Power Winch

Managing Hunting Disturbance

Spatial Refuge

Vs.

Temporal Refuge

Conceiving a Moist-soil Management Strategy